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Trichloroethylene Toxicity Information (TCE) CAS # 79-01-6

BACKGROUND INFORMATION

No trichloroethylene (TCE) toxicity values are currently available on the IRIS database. TCE toxicity values and sources of information have historically varied. These differences have contributed to some confusion as to which toxicity factor to use for calculating cleanup levels. WAC 173-340-708 (7) and (8) specifies the appropriate sources of toxicity information as IRIS, HEAST, and NCEA.

In August 2001, EPA published a new health risk assessment for TCE[1]. The TCE toxicity values and supporting documentation have been reviewed and endorsed by NCEA's Superfund Technical Support Center and reviewed by EPA's Science Advisory Board. The Office of Research and Development (ORD), EPA, working with the National Academy of Sciences (NAS) are preparing responses to the Science Advisory Board's comments on TCE. The IRIS review process will occur after the ORD / NAS evaluation has been completed.

Trichloroethylene Toxicity Information (TCE) CAS # 79-01-6				
Oral Cancer Potency Factor (CPFo) / Oral Slope Factor (SFo) [(mg/kg-day)$^{-1}$]	Inhalation Cancer Potency Factor (CPFi) / Inhalation Slope Factor (SFi) [(mg/kg-day)$^{-1}$]	Oral Reference Dose (RfDo) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Source of Information
0.02 - 0.4	0.02 - 0.4	0.0003	0.01 (0.04 mg/m^3)	EPA, 2001 NCEA Draft Health Risk Assessment

The Office of Environmental Assessment (OEA), EPA Region 10, advises human health risk assessors to utilize the 2001 external review draft of the TCE health risk assessment until a formal assessment and accompanying cancer and non-cancer toxicity values are incorporated into the IRIS database. This assessment relied on animal studies, as well as human epidemiological studies that were not available when the cancer assessments were prepared for EPA's now-withdrawn provisional values or Cal-EPA's current cancer toxicity values. The use of the toxicity values in this document was endorsed by NCEA's Superfund Technical Support Center[2]. The assessment has been subject to a public comment period as well as formal review by the Science Advisory Board. The EPA Office of Research and Development, with support from the National Academy of Sciences, will prepare responses to the SAB comments and evaluate studies that have become available since the external review draft was published. The IRIS review process will occur after this ORD/NAS evaluation has been completed.

[1] Trichloroethylene Health Risk Assessment: Synthesis and Characterization (External Review Draft). U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington Office, Washington DC, EPA/600/P-01/002A, 2001.

[2] E-mail message from Ann Parker of the NCEA Superfund Technical Support Center to Sarah Levinson of EPA Region 1 dated June 20, 2003 (copy available from EPA Region 10 upon request).

Following are the TCE toxicity values from the EPA 2001 external review draft health risk assessment.

Oral Cancer Potency Range [(mg/kg-day)$^{-1}$]	Inhalation Cancer Potency Range [(mg/kg-day)$^{-1}$]	Oral Reference Dose (mg/kg-day)	Inhalation Reference Concentration (mg/m3)**
0.02 - 0.4	0.02 - 0.4*	0.0003	0.04

* Converts to an inhalation unit risk range of 5.7E-6 – 1.1E-4 [(ug/m3)$^{-1}$].
** Converts to a reference dose of 0.01 mg/kg-day.

RECOMMENDATION

Consistent with EPA Region 10 Office of Environmental Assessment, and until a cancer potency factor is incorporated into the EPA IRIS database, TCE cleanup levels under MTCA should use 0.4 (mg/kg-day)$^{-1}$ as the cancer potency factor (slope factor) for ingestion and inhalation of trichloroethylene in risk assessments and in calculating risk-based cleanup levels. This slope factor represents the high end of the oral and inhalation cancer potency range in EPA's Trichloroethylene Health Risk Assessment: Synthesis and Characterization (External Review Draft). The quantitative characterization of cancer risk to humans from TCE exposure is likely to be enhanced in the future with the emergence of further studies and additional analyses of human variability and susceptibility. At this time, using the high end of the oral and inhalation cancer potency range is reasonable and protective, given the best available science, and is appropriate for use in MTCA equations, based on the following reasons:

- The draft assessment concluded that "TCE is highly likely to be carcinogenic in humans." While the qualitative assessment of cancer risk appears strong, there are many uncertainties in the current ability to quantitatively characterize cancer risks to humans from TCE exposure. The results of human epidemiological studies showed a considerably wide range of possible slope factors, contributing to the inclusion of a slope factor range in the draft assessment, rather than a single estimate of the relationship between exposure and risk. It is not clear that even the high end of the slope factor range represents a true upper bound estimate of risk.
- The quantitative characterization of cancer risk to humans from TCE exposure is likely to be enhanced in the future with the emergence of further studies and additional analyses of human variability and susceptibility.
- The draft assessment concludes that it appears that children's metabolism may alter their susceptibility to TCE, and that this is an uncertainty that cannot be reduced without additional studies being performed. Therefore, the selection of the high end of the slope factor range is a reasonably prudent decision for the protection of children who may be exposed to TCE.
- Exposures to certain chemicals other than TCE were found to increase TCE's toxicity or potency, and vice-versa. These include exposure via ingestion to such commonly used substances as alcohol and acetaminophen, as well as to other sources of the metabolites of TCE.
- Certain individuals (e.g., diabetics) may be at higher risk for TCE's adverse effects.
- The EPA 2001 TCE health risk assessment (page 1-7) includes the following supportive language:

  The range of cancer slope factors has not been reduced to a single number. A range is reasonable in view of the risk factors that can modify the effects of TCE in different populations…. For most cancer risk factors, however, data that would allow differential risks to be quantified are lacking…Because the modifying effect of most risk factors cannot be quantified at this time, this assessment proposes instead that risk assessors use the upper end of the slope factor range for

susceptible populations having risk factors for TCE-induced cancer. Although the extremes of the slope factor range are not based on data from more- or less-susceptible populations, this approach emphasizes the possibility of different risks in different circumstances, identifies risk factors that may increase susceptibility to TCE's effects, and provides a practical way to adjust risk estimates to reflect differential susceptibility.

The Draft TCE Toxicity Assessment is available online at:
http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=23249

The Science Advisory Board's Review is available online at:
http://www.epa.gov/science1/pdf/ehc03002.pdf

Examples of national uses of the 2001 TCE Health Risk Assessment

Risk-based chemical screening tables developed and used by EPA Region 3 (http://www.epa.gov/reg3hwmd/risk/human/index.htm), Region 6 (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and Region 9 (http://www.epa.gov/region09/waste/sfund/prg/index.htm) all cite the high end of the slope factor range, to prevent screening out site-related chemicals that may pose significant risk.

EPA's Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (November 29, 2002; http://www.epa.gov/correctiveaction/eis/vapor.htm) incorporates the high end of the slope factor range for evaluating risks from exposure to TCE via the vapor intrusion pathway.

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Tetrachloroethylene Toxicity Information
(Perc, PCE, Perchlorethylene)
CAS # 127-18-4

BACKGROUND INFORMATION

Some of the toxicity information for tetrachloroethylene is summarized in the table below. Changes in the toxicity information reflect the dynamic nature of the databases as new information becomes available and is evaluated.

Tetrachloroethylene Toxicity Information (Perc, PCE, Perchlorethylene) CAS # 127-18-4				
Oral Cancer Potency Factor (CPFo) / Oral Slope Factor (SFo) [(mg/kg-day)$^{-1}$]	Inhalation Cancer Potency Factor (CPFi) / Inhalation Slope Factor (SFi) [(mg/kg-day)$^{-1}$]	Oral Reference Dose (RfDo) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Source of Information
0.54	0.021*	Not available	Not available	Cal-EPA
0.54	0.021	Not available	Not available	NCEA Provisional, Withdrawn
Not available	Not available	0.01	Not available	IRIS

*converted from a unit risk of 5.9E-6 per ug/m3.

- The oral reference dose for tetrachloroethylene, available in IRIS and reflected in CLARC V 3.1, is 0.01 mg/kg-day. Cancer potency factors for tetrachloroethylene have never been available on IRIS. However, the information associated with the development of cancer potency factors for tetrachloroethylene is being reviewed by the IRIS program. Until cancer potency factors are incorporated in IRIS, NCEA has agreed that the use of Cal-EPA oral and inhalation cancer potency factors are appropriate and should be used for future assessments. The oral cancer potency factor for tetrachloroethylene listed in CLARC V 3.1 [0.051(mg/kg-day)$^{-1}$] is based on a withdrawn NCEA value and should no longer be used under MTCA cleanups. EPA issued an Office of Solid Waste and Emergency Response (OSWER) technical memorandum on June 12, 2003 (OSWER No. 9285.7-75; From Elizabeth Southerland to Dr. Marcia Bailey) which supports the use of the Cal – EPA cancer potency information, based on input from NCEA toxicologists.

RECOMMENDATION

The current carcinogenic risk values to be used in calculating cleanup levels for tetrachloroethylene under MTCA (from the OSWER technical memorandum No. 9285.7-75) are:

- Inhalation Unit Risk, 5.9E-6 per ug/m3 (converted to an inhalation cancer potency factor of 0.021 per mg/kg-day); and
- Oral Cancer Potency, 0.54 per mg/kg-day.

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